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High-speed Video from Asynchronous Camera Array (Poster)

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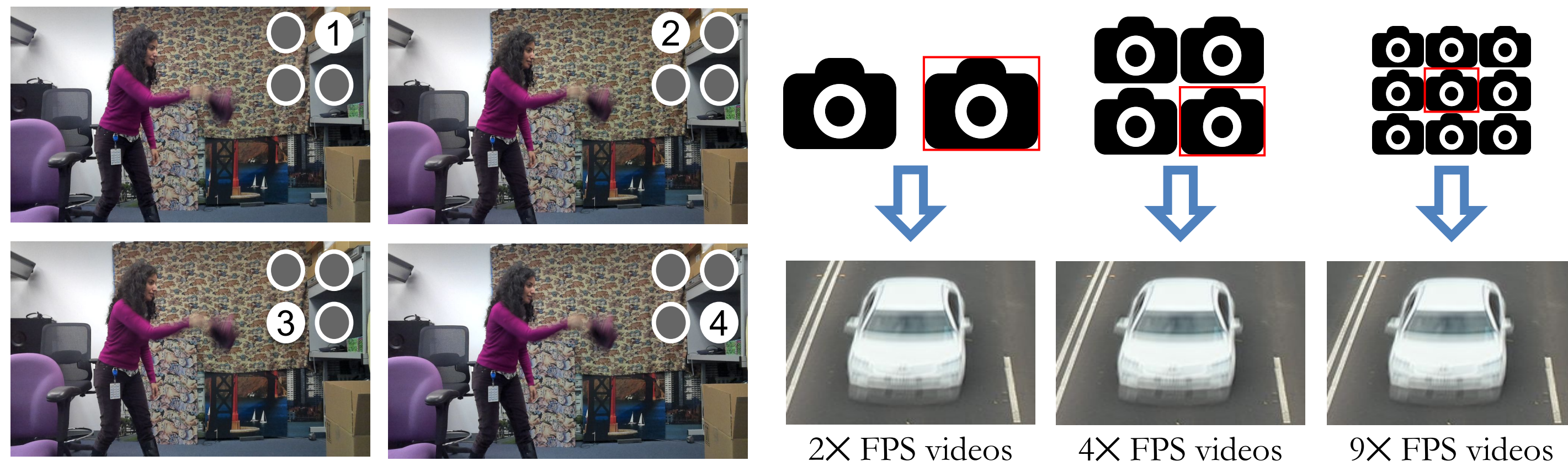
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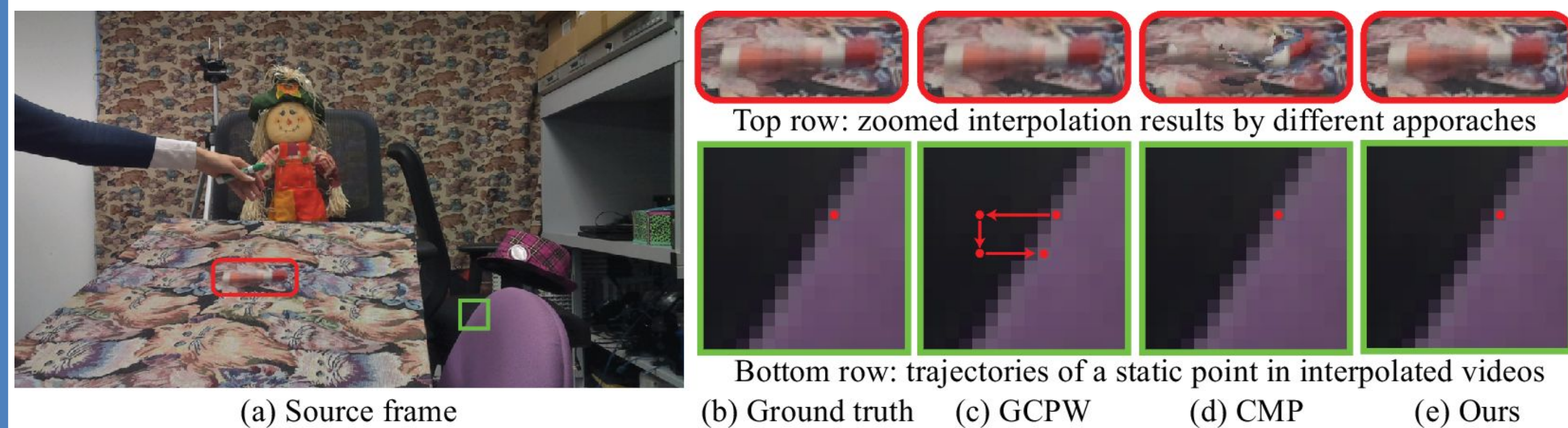
Overview and Motivation

- Explores camera arrays for high-speed videography
- Sequentially firing each sensor in a camera array with a small time offset
- An economic solution for high-speed video capturing: using cheap normal-speed sensors
- Could flexibly exploit expensive high speed (FPS) cameras → generate videos with even higher FPS
- Better meet the demand for high data throughput from high-speed imaging than a single-sensor camera



Related Works

- Traditional optical flow methods do not work well at object boundaries or in textureless regions
- Existing edge-aware approaches perform better at object boundaries, but could not handle large motions
- Optical flow errors can occur and lead to noticeable visual artifacts when using flow-based interpolation
- Adaptive CNN & content-aware CNN achieves STOA performance, but can not handle fast moving objects
- Our method differs from those frame interpolation methods in that we have extra frames that are captured at the same time but from different viewpoints.

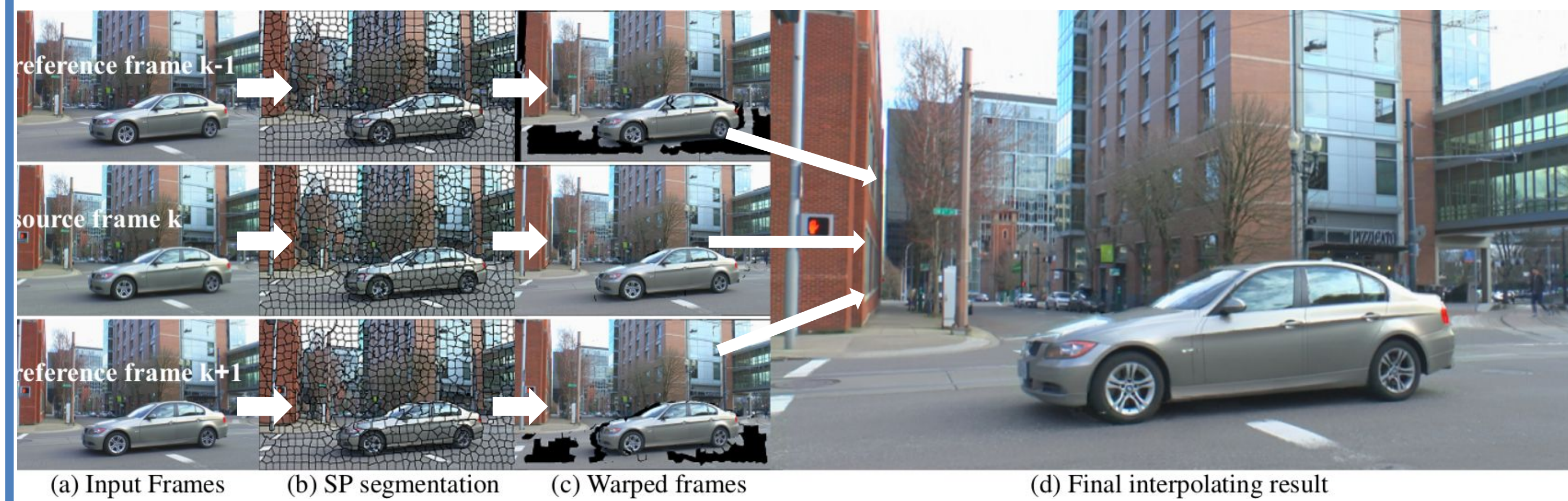


Frame synthesis for high-speed video. (a): a source frame. (b): ground truth of the interpolated content (top) and the trajectory (bottom) of a static pixel. Global content-preserving warp (GCPW) [24] suffers from parallax jittering in local regions as shown in (c) bottom. A state-of-the-art optical flow-based method (CMP) [17] cannot handle blurry object as shown in (d) top. Our method produces visually plausible results as shown in (e).

- The key enabling algorithm is a high-quality novel view synthesis algorithm that transforms video frames captured by spatially-distributed lenses as if they were captured by a common lens to avoid parallax jittering.
- This novel view synthesis method uses **local spatially-varying warping & multi-label MRF optimization**.
- Produce plausible novel views from multiple frames while avoiding ghosting artifacts & handling parallax

Methodology: Framework

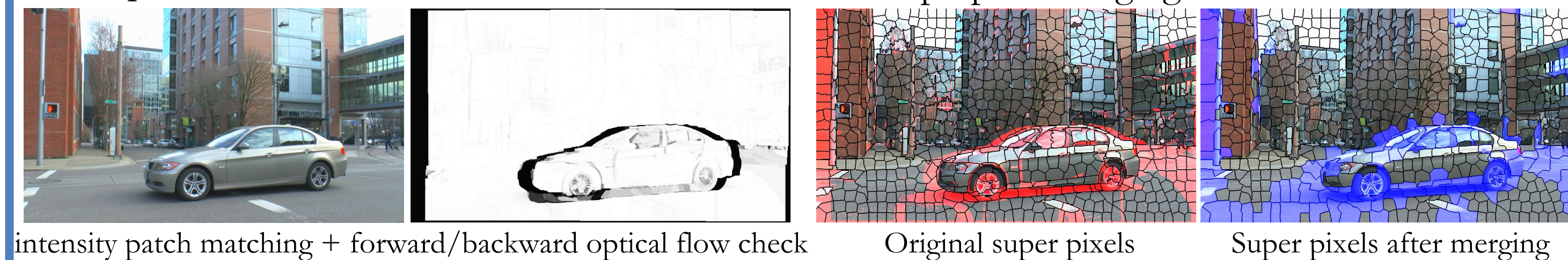
- Optical flow guided local warp
- Labeling-based Rendering



An example of our method. The three input frames (a), including two reference frames and one source frame, are over-segmented into superpixels (SP) (b), locally warped to the target position (c), and blended using our multi-label based optimization scheme (d).

Methodology: Optical flow Guided Local Warp

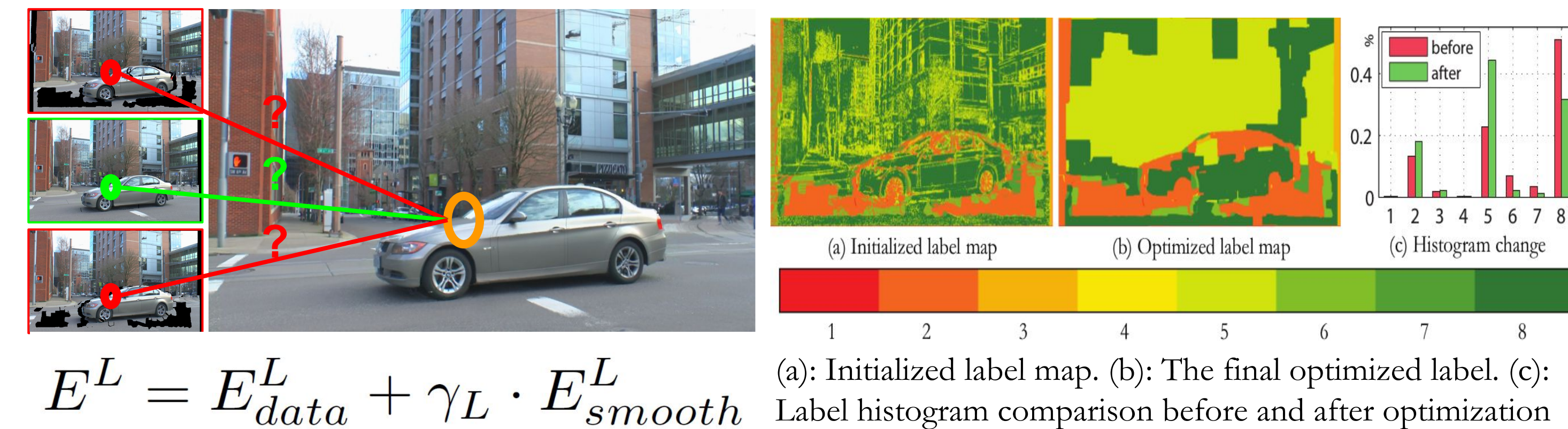
- Optical flow validation
- Superpixel merging



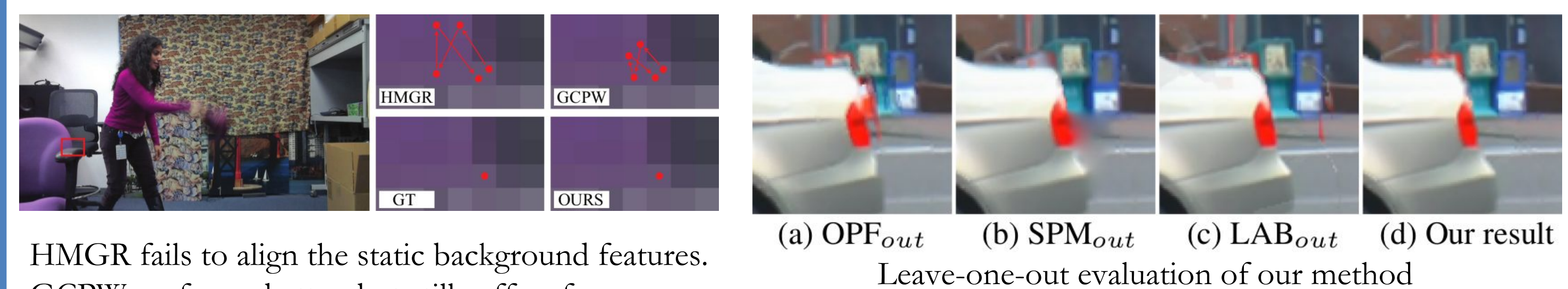
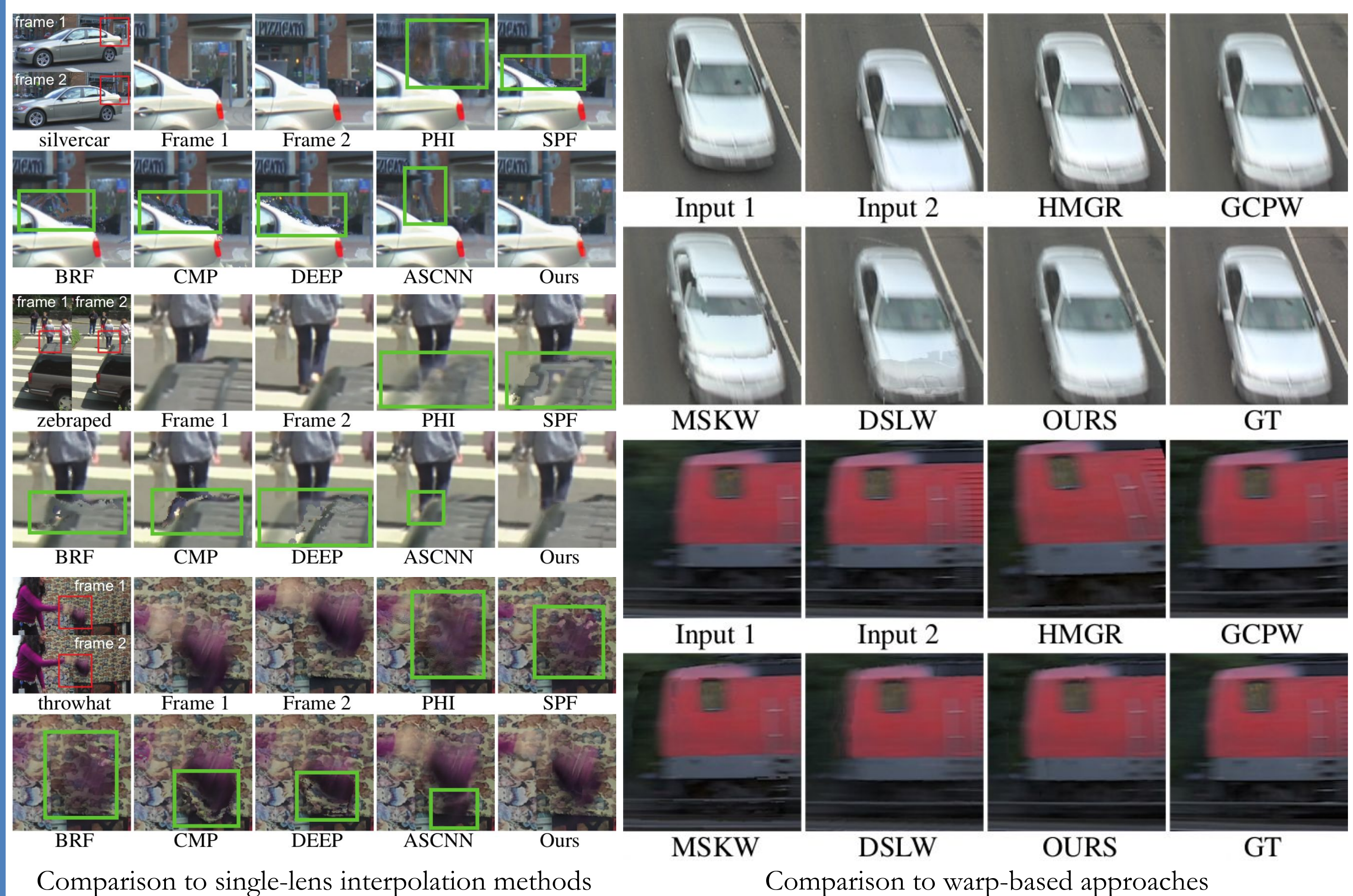
- Local content-preserving warp



Methodology: Labeling-based Rendering



Experiment Results



HMGR fails to align the static background features. GCPW performs better, but still suffers from moderate parallax jittering.

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